

2

UNIVERSITY OF CALIFORNIA  
GRADUATE DIVISION, NORTHERN SECTION

**SUMMARY OF THE DISSERTATION**  
SUBMITTED IN PARTIAL SATISFACTION  
OF THE REQUIREMENTS FOR THE  
**DEGREE OF DOCTOR OF PHILOSOPHY**

BY

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B.S. (Ohio State University) 1949

M.A. (University of California) 1952

ZOOLOGY

SEPTEMBER 1955

COMMITTEE IN CHARGE:

Professor CURT STERN, *Chairman*,

Professor I. MICHAEL LERNER,

Professor DANIEL MAZIA.

BIOGRAPHICAL

- 1922 —Born in Cleveland, Ohio.  
1942–1946—Private to Sergeant, Army Air Corps.  
1949 —B.S., Ohio State University.  
1952 —M.A., University of California.  
1954–1955—Agency Scholar, National Association of Artificial Breeders, at  
the University of California.  
1949–1955—Graduate Student, University of California.

## DISSERTATION

### PHYSICO-CHEMICAL INVESTIGATIONS ON RABBIT SPERMATOZOA, WITH SPECIAL REFERENCE TO ELECTROPHORETIC SEPARATION OF X- AND Y-CHROMOSOME-BEARING SPERMATOZOA

Measurements of lengths and widths of stained rabbit spermatozoa heads were made. The plotted distribution produced a curve with two major maxima. Since previous workers theorized that such a bimodality may be an expression of sex dimorphism, measurements were repeated after electrophoretic separation on anode- and cathode-migrating sperm cells. Each fraction showed the same bimodality. If electrophoresis actually separates male- and female-producing spermatozoa, then head size is not a reflection of sex dimorphism.

Experiments were conducted in an attempt to repeat the work of V. N. Shreder who was able to control the sex of rabbit offspring by artificial insemination of electrophoretically separated spermatozoa with an accuracy of approximately 80 per cent. The results of the present work are comparable. The sex of sixty-six offspring was correctly predicted from a total of eighty-three young produced. Statistical tests show these results to be highly significant in their deviation from the normal sex ratio. The results obtained seem to be based on the phenomenon that X- and Y-chromosome-bearing spermatozoa apparently have different isoelectric points. The differences exist at the cell surface and are probably a reflection of the differences in nuclear content.

Electrophoresis, by the moving boundary method, of homogenized electrophoretically separated spermatozoa, showed that a detectable difference in protein patterns exists between anode- and cathode-migrating sperm cells. These results verify the fact that anodal and cathodal spermatozoa are two different populations. As far as can be determined this work is the first to present direct evidence of an intrinsic difference existing in sperm cells from a single ejaculate. It parallels the findings from artificial insemination according to which anode and cathode sperm consist of X-chromosome and Y-chromosome-containing spermatozoa respectively.

## GRADUATE STUDIES

### *Field of Study: ZOOLOGY.*

Research in Zoology. Professor Curt Stern.

Genetics Review. Professor Curt Stern.

Seminar in Advanced Genetics. Professors Richard Goldschmidt and Curt Stern.

Introduction to Physicochemical Biology. Professor Daniel Mazia.

Optics and Metrology in Biology. Professor J. E. Gullberg.

Advanced Genetics. Professor D. C. Rife, Ohio State University.

Advanced Human Genetics. Professor J. N. Spuhler, Ohio State University.

### *Other Studies:*

Physiological Genetics. Professor S. W. Brown.

Organic Evolution. Professor G. L. Stebbins, Jr.

Biometry. Professor E. L. Green, Ohio State University.